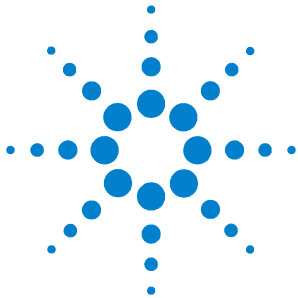
Agilent J7230A

OmniBER OTN
10 Gb/s communications
performance analyzer

Quick Reference Guide

Agilent Technologies



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In This Quick Reference Guide...

This guide contains information on:

- The conventions used within this guide.
- A Getting Started chapter for new users.
- An introduction to using the Graphical User Interface (GUI), including information on the display windows, the menus and basic GUI operations.
- An introduction to using Online Help, including information on how to add and use your own help files.
- Using Smart Test and SignalWizard, the quick and easy way to set up and use the instrument.
- Tutorials to help familiarize yourself with setting up measurements and logging the results. Separate SONET, SDH and OTN versions are included.
- Some tips on avoiding problems when making measurements.
- Quick reference tables listing the front panel settings to rapidly select major instrument functions.

Conventions Used in This Guide...

- Front panel buttons appear in bold within angled brackets. For example, press **<Menu>**.
- When buttons are connected by a plus (+) sign, for example, **<2>** + **<4>**, press the listed buttons in sequence.
- Menu items appear in bold. The greater than (>) symbol separates each menu level. For example, `**Test Functions > Errors and Alarms**' indicates that you should choose `Errors and Alarms' from the `Test Functions' main menu.
- Field items and drop down list entries appear in **bold**. For example, `select **Signal Rate** field and choose **OC-3** from the drop-down list'.
- This Guide applies to both SONET, SDH and OTN network standards. Where there is a difference in the terminology used between SONET and SDH standards, the SONET version is given first.

Contents

7 Measurement Tutorial - SONET

8 Measurement Tutorial - SDH

9 Hints and Tips

10 Quick Reference Tables

1
Product Description

Introduction

The Agilent J7230A OmniBER OTN provides a rich feature set for developing and testing equipment designed for the Optical Transport Network (OTN), which meets the G.709 standard and also provides full SONET/SDH testing capability from 52 Mb/s to 10 Gb/s.

- ITU-T G.709 test at 10.71 Gb/s and 2.66 Gb/s
- SONET/SDH plus PDH/DSn test at all rates from 1.5Mb/s to 10Gb/s
- Generation of mixed mappings
- Simultaneous all-channel testing (up to 192 STSs/AUs)
- Comprehensive OTN/SONET/SDH overhead testing
- Alarm stress testing
- Transmit and Receive event output triggers
- Thru-mode operation - transparent and overwrite
- Comprehensive online help
- Graphical measurement results

Option Guide

This guide explains the features offered with each instrument mainframe and its associated options.

Optical Test Interfaces	Mainframe
OC-1, OC-3, OC-12, OC-48, OC-192 STM-0, STM-1, STM-4, STM-16, STM-64	**J7230A**

Mainframe Configuration	Option
Side mounted connectors	J7230A - 004
Rear mounted connectors	J7230A - 005

OTN Interfaces

G.709 Optical Test Interfaces	Option
Adds OTU-1 at 2.66Gb/s	J7230A - 111
Adds OTU-2 at 10.71Gb/s	J7230A - 112

PDH/DSn Testing

DSn/PDH Test	Option
DSn/PDH framed/unframed testing plus DSn/PDH electrical interfaces	J7230A - 012

Optical Interfaces at 10 & 10.7 Gb/s

	Interface	Option
1550nm	10Gb/s	J7230A - 108
	10Gb/s & 10.7Gb/s	J7230A - 110

Optical Interfaces for 52Mb/s to 2.5Gb/s*

	Option
1310nm only	J7230A - 104
1550nm only	J7230A - 105
Dual wavelength 1310nm/1550nm	J7230A - 106

*52 Mb/s to 2.5 Gb/s optical options include 52 Mb/s and 155 Mb/s electrical interfaces.

Mixed Mappings

Mixed mappings	Option
Firmware only option that adds mixed mappings plus STS-6c, -9c, -24c and VC-4-2c, -4-3c, -4-8c	J7230A - 510

Optical Connectors (product options)

Connector	Option
FC/PC Adapters fitted on all optical interfaces	J7230A - 609
SC Adapters fitted on all optical interfaces	J7230A - 610
ST Adapters fitted on all optical interfaces	J7230A - 611

Other Options

Certificate of Calibration

Option UK6: Calibration certificate with test data.

Warranty and Service Plans

Terms and conditions of the applicable warranty for this product are contained in the sales and related documentation supplied separately.

Please contact your nearest Agilent Technologies Sales Office for further information on warranty and extended warranty options.

For access to Agilent Product information and sales/service contacts, please visit http://www.agilent.com.

Accessories

Additional Documentation

J7270A Option ABA:

Full set of English printed manuals which include:

User's Guide
Remote Control Manual
Verification Manual
Quick Reference Guide
CD-ROM

Carrying Cases

J7266A: Hard transit case (for J7230A option 004).

Optical Adapters and Cables

J7283A: FC/PC optical connector (exchangeable)

J7284A: SC optical connector (exchangeable)

J7285A: ST optical connector (exchangeable)

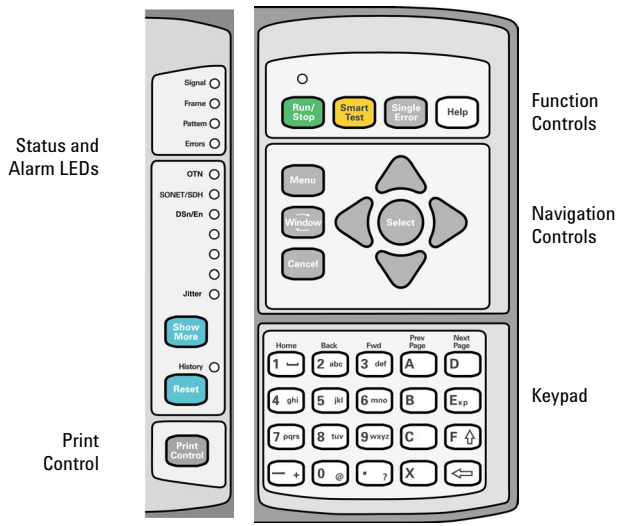
J7281A: DCC port converter cable: 9-pin miniature D-type to 37-pin D-type (RS-449, female)

J7269A: Trigger output cable 9-pin mini D-type to dual BNC (m).

2
Front and Side Panel Tour

This chapter guides you round the many features of the instrument.

Front Panel Tour

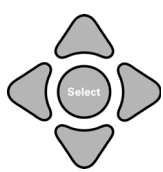


Function Controls

Run/ Stop	Press this button to start a new test period or terminate the current test period. The LED indicator above the button is on when a test period is in progress.
Smart Test	Press this button to access the Agilent Smart Test menu.

	Press this button to add a single error to the transmitted signal. The type of error added is selected on the **Test Functions > Errors and Alarms** page.
	Press this when you need to refer to the online help. Press it again to take you back to the instrument display.

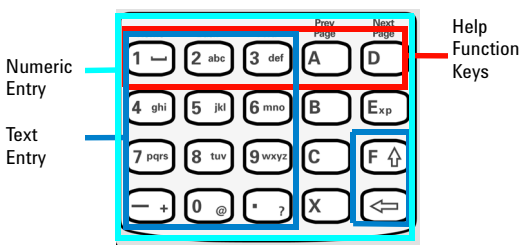
Navigation Controls

	The **<Arrow Navigation>** buttons move the focus up/down/left/right through menus, drop-down lists and the instrument display. Press **<Select>** to enter any selected menu item or value you have entered into a field.
	Press **<Menu>** to display the main menu for the current application. Press **<Menu>** again, or press **<Cancel>,** to close the menu.
	Press **<Window>** to change the focus between the left and right windows.
	**<Cancel>** will close any menu or drop down list without making any changes.

Keypad

The keypad provides quick text and numeric entry. Some keys are also used for navigation in the online help system.

The operation of the keys depends on the mode of operation for the current entry field.



Numeric Entry

In a numeric entry field, enter the number you want using the keypad. Decimal, binary and hexadecimal entries are all made directly from the keypad.

Special keys used in numeric entries:

	Press **<Minus>** to enter a negative value, for example for a frequency offset of -99.9 ppm, press: **< - > + <9> + <9> + < . > + <9>**
	Press **< X >** for 'don't care' entries.
	Use this key to enter an exponent, for example for an error rate of 9.9E-9 press: **<9> + < . > + <9> + <Exp> + < - > + <9>**
	Press the **<Left Arrow>** key for backspace operation, thus deleting preceding entry.

Text Entry

The keypad is in text mode when a text entry field is displayed, for example when editing a trace message.

Enter text in the same way as you would enter text into a cell phone. The keys are labelled “abc2ABC”, “def3DEF” and so on. Press the key with the character you want: once for the first character, twice (pressing the key quickly in succession) for the second and so on.

To enter numbers or upper case letters quickly, use the **<F/up arrow>** key to switch between lower case characters (CapsOff), upper case (CapsOn) and number (Num). The current mode is displayed in the Status Line at the bottom right of the screen.

Special keys used in text entries:

	This key switches between upper and lower case characters and numbers. The current mode, either “Caps” or “Num” - is displayed at the bottom right of the screen on the Status Line.
	Press this key for these special characters: **space _ NUL LF CR**
	Press this key for these math symbols **- + / * = < > % ^**
	Press this key for these miscellaneous symbols **@ # 0 $ \ & ~ ( ) [ ] { }**
	Press this key for these punctuation symbols **. ? ! , : ; “ ‘ ‘**

Help Function Keys

These keys are used for additional navigation when in Online Help.

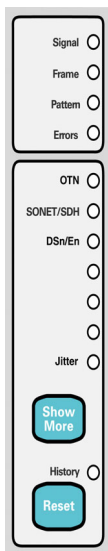
Home 	Returns you to the Home page.
Back 	Takes you back to the previous page.
Fwd 	If you have used the **<Back>** key for navigating then this key takes you forward to where you have come from. Otherwise, pressing this key has no effect.
Prev Page 	Scrolls up through the displayed page.
Next Page 	Scrolls down through the displayed page.

Print Control

	Press **<Print Control>** to access the print control page.

Status and Alarm LEDs

The Status LED indicators provide information about the status of the instrument's receiver. The Signal, Frame and Pattern indicators are green if the signal is good, and red during an alarm condition. Errors indicator is red if an error is detected.



SIGNAL Green: Valid signal (level; data transitions) detected at input. Red: No data transitions detected at input or low optical/electrical power.

FRAME Green: Correct framing detected at all levels of the received signal (on the line signal plus all levels down to the selected test channel). Red: Frame alignment lost at one or more levels of the received signal.

PATTERN Green: Correct detection of expected test pattern. Red: Expected test pattern not received.

ERRORS Red: An error has been detected in the received signal. The indicator remains red for 100 ms, then returns to off.

OTN: Indicates that an OTN alarm is present.

SONET/SDH: Indicates that a SONET or SDH alarm is present.

DSn/PDH: Indicates that at least one ANSI DS0, DS1, DS2 or DS3 or at least one ETSI E0, E1, E2, E3 or E4 alarm is present.

History: Press **<Show More>** to view the alarm history. **<Show More>** provides access to the detailed alarm information (both current status and history). If an alarm has occurred during the current test period, the History indicator will be on.

Press **<Reset>** to reset the Alarm History data. The History LED will go off. If an alarm condition is present during the reset, then the LEDs associated with that alarm will remain on after the reset. Resetting of the history data also occurs when you start a new test period.

Side Panel Tour

Optical Out Ports

The optical out ports provide OTN optical signals at 10.71 Gb/s (G.709 OTU2) and 2.66 Gb/s (G.709 OTU1), SONET optical signals OC-1, OC-3, OC-12, OC-48, OC-192 and SDH optical signals STM-0, STM-1, STM-4, STM-16, STM-64 at wavelengths of 1310 and 1550 nm, depending on instrument model and options.

52 Mb/s - 2.66 Gb/s 1310 nm

Selectable optical connector (see “Optical Connectors (product options)” on page 12) for a 52 Mb/s to 2.66 Gb/s optical output. Nominal wavelength is 1310 nm. Power output is -5 to +0 dBm.

52 Mb/s - 2.66 Gb/s 1550 nm

Selectable optical connector (see "Optical Connectors (product options)" on page 12) for a 52 Mb/s to 2.66 Gb/s optical output. Nominal wavelength is 1550 nm. Power output is -2 to +3 dBm.

9.95/10.71 Gb/s, 1550 nm

Selectable optical connector (see "Optical Connectors (product options)" on page 12) for a 9.95 Gb/s or a 10.71 Gb/s optical output. Nominal wavelength is 1550 nm. Power output is -1 to +1 dBm.

Optical In Ports

The optical input ports accept OTN G.709 OTU1 and OTU2 signals, SONET OC-1, OC-3, OC-12, OC-48 and OC-192 and SDH STM-0, STM-1, STM-4, STM-16, STM-64 signals, depending on the model and options fitted.

52 - 2.5/2.66 Gb/s

Selectable optical connector (see "Optical Connectors (product options)" on page 12) for a 52 Mb/s to 2.5/2.66 Gb/s optical input (OC-1, OC-3, OC-12, OC-48, OTU1/STM-0, STM-1, STM-4, STM-16 signals). Wavelength 1200 to 1600 nm. Input damage power >+3 dBm; never exceed maximum input power.

9.95/10.71 Gb/s

Selectable optical connector (see "Optical Connectors (product options)" on page 12) for a 9.95 or 10.71 Gb/s optical input (OTU2/OC-192/STM-64 signals). Wavelength 1290 to 1565 nm. Input damage power >+1 dBm; never exceed maximum input power.

Clock Ports

2 Mb/s, 2 MHz, 10 MHz Clock In

BNC 75 ohm (nominal) unbalanced connector for a 2 Mb/s, a 2 MHz MTS or a 10 MHz external clock source input.

2 Mb/s, 2 MHz Clock In

3-pin Siemens connector for a 2 Mb/s and 2 MHz MTS external clock source input.

DS1 Clock In

Bantam 100 ohm (nominal) connector for a DS1 BITS external reference clock input.

2 MHz Clock Out

BNC 75 ohm (nominal) unbalanced connector for a 2 MHz MTS clock reference output. Generated relative to the selected transmit reference clock.

DS1 Clock Out

Bantam 100 ohm (nominal) connector for a DS1 BITS clock reference output. Generated relative to the selected transmit reference clock.

TX Eye Clock 52 - 2.66 Mb/s

SMA connector providing a TX Eye Clock signal (at 1/4 of the line rate) which can be used to trigger an oscilloscope when examining data signals.

TX Eye Clock 10/10.71 Gb/s

SMA connector providing a TX Eye Clock signal (at 1/16 of the line rate) which can be used to trigger an oscilloscope when examining data signals.

DCC/GCC and Trigger Port

Connector: 9-pin miniature D-type.

Use as a DCC/GCC Port

Use this port to insert and drop either the D1-D3 DCC channel, the D4-D12 DCC or the OTN GCC channels. The first bit of data inserted will be put into the MSB of the DCC/GCC channel. The MSB of the dropped data bytes will be output first. The

transmit (drop) and receive (insert) capabilities are independent, that is, the transmit and receive clock rates can be set to different rates. Note that the instrument acts as a DCE (Data Communications Equipment), that is, it will supply the clock signal for both drop and insert operation.

Pin Number	RS-449/422 Circuit
1	Rx Data Output (+)
2	Rx Clock Output (+)
3	Signal ground
4	Tx Clock Output (+)
5	Tx Data Input (+)
6	Rx Data Output (–)
7	Rx Clock Output (–)
8	Tx Clock Output (–)
9	Tx Data Input (+)

Rate:	D1-D3 DCC: 192 kb/s D4-D12 DCC: 576 kb/s. GCCO/1/2 1.3124 Mb/s
Termination	The DCC port to BNC trigger connector accessory only uses the positive side of the differential trigger signal. A 50ohm serial resistor is incorporated into the cable and it is recommended that to maintain voltage levels the signal is terminated with 1 Mohm in the oscilloscope or other equipment.
Input Termination:	100 ohms differential.

Input Sensitivity:	200 mV over a common-mode input voltage range from -0.3V to 5.5V.
Output Level	Logic '1'=2.3V typical; Logic '0'=0.8V typical

Use as a trigger port

Several triggers are available on pins 1,6 (transmitter) and 2,7 (receiver) of the DCC connector in order to allow you to synchronize to different events. For information on transmit and receive trigger events see the Online Help.

Electrical Test Ports

SONET/SDH Out

BNC 75 ohm unbalanced connector for an STS-1/STM-0 (B3ZS) or STS-3/STM-1 (CMI) electrical output.

SONET SDH In

BNC 75 ohm unbalanced connector for an STS-1/STM-0 (B3ZS) or STS-3/STM-1 (CMI) electrical input. Input Mode - Terminate or Monitor. Monitor mode conforms to G.772-1993. Monitor Gain - 20 or 26 dB.

J7230A option 012 is required for the following ports to be active.

2 Mb/s Out

3-pin Siemens 120 ohm balanced connector for an E1 Transmit or E1 Drop signal output. Either this port or the 2-140 Mb/s DS3 unbalanced Out port can be active for the E1 Transmit function.

2 Mb/s In

3-pin Siemens 120 ohm balanced connector for an E1 Receive or E1 Insert signal input. Either this port or the 2-140 Mb/s DS3 unbalanced In port can be active for the E1 Receive function.

DS1 Out

Bantam 100 ohm balanced connector for a DS1 Transmit or DS1 Drop output.

DS1 In

Bantam 100 ohm balanced connector for a DS1 Receive or DS1 Insert input.

2-140 Mb/s DS3 Out

BNC 75 ohm unbalanced connector for E1, E2, E3, E4, DS3 transmit or E1, E3, E4, DS3 Drop output signals. Either this port or the 2 Mb/s balanced Out port can be active for E1 Transmit function.

2-140 Mb/s DS3 In

BNC 75 ohm unbalanced connector for E1, E2, E3, E4, DS3 receive or E1, E3 and E4 DS3 Insert input signals. Either this port or the 2 Mb/s balanced In port can be active for E1.

Other Side Panel Connectors

These connectors are at the base of the left panel and are described from left to right.

Floppy Disk Drive

Accepts 1.44 MB IBM formatted disks.

USB

Two Universal Serial Bus ports for connecting to a printer.

Mouse

PS/2 port for connecting a mouse. The mouse can not be hot-plugged into the instrument; power the instrument off to connect the mouse.

Keyboard

PS/2 port for connecting an external keyboard. The keyboard can be hot-plugged for use at any time. Ensure that keyboard port is used - if connected to mouse PS/2 port in error the instrument will require to be restarted.

RS232

Remote Control port providing following configurations:

Controller Type:	Computer and Terminal.
Protocol:	None and Xon/Xoff.
Speed:	300, 600, 1200, 1800, 2400, 4800, 9600, 19200 baud.
Parity:	Odd, Even, 1s, 0s.
Stop Bits:	1, 2
Data Length:	7 bits.

VGA

Connector for displaying contents of instrument screen on an external display. Ensure that the external display is connected before powering up the instrument.

LAN 10M/100M

10/100 Base-T LAN interface port. Supports remote control of instrument and the downloading of firmware upgrades.

10 Base-T LAN Connection Radiated Emissions: To ensure compliance with EN 55011 (1991) a category 5, STP patch lead, RJ45 cable should be used to connect to the LAN port.

Rear Panel Connectors

GPIB

Allows test set to be remotely controlled via the GPIB control bus.

External Protective Earth

Connect an external earth connection to the instrument at this point.

AC Power

Connect the instrument power cord here and set the switch to 1 to turn on and to 0 to turn off.

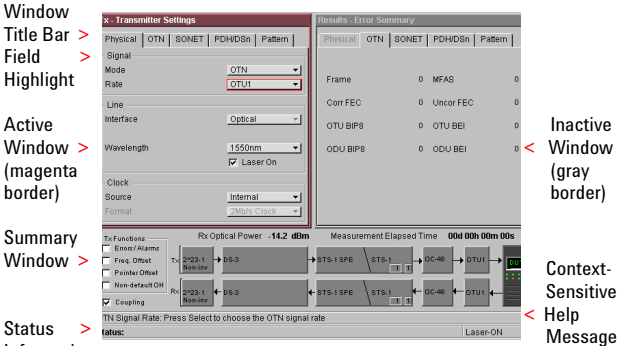
2 Front and Side Panel Tour

3 Using the Graphical User Interface

The graphical user interface (GUI) with windows, menus and dialogs provides easy access to all the instrument setup, monitoring and results pages together with constant display of context-sensitive help and instrument status. The interface also allows you to use the built-in help system which gives detailed information on using the instrument.

Display Windows

Instrument Windows

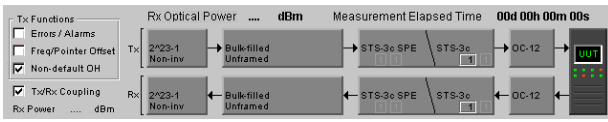


Two main windows display the pages for setting up, monitoring and viewing results. Only one of these windows is active at a time. The active window is indicated by a colored (magenta) border. You can change the active window by pressing the **<Window>** button next to the arrow navigation buttons. Move around within a window by using the arrow navigation buttons. The current position on the window is shown by a red highlight box around the control field. The title of the current page is given at the top of the window in the title bar. This also gives the menu name that the page has come from, for example Overhead Setup - Trace Messages is the Trace Messages page selected from Overhead Setup on the menu.

A single line of Context-sensitive help appears at the bottom of the display. This gives you helpful information relating to the area of the screen that is highlighted by the red box.

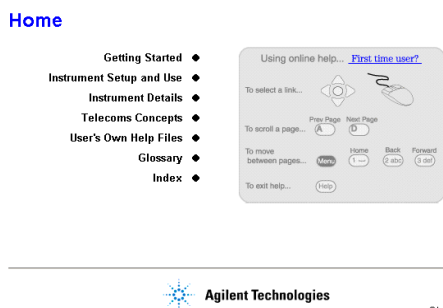
The Status line displays the instrument and keyboard status.

The Summary diagram is located at the bottom of the screen. It displays the current setup of the Transmitter and Receiver, along with Test Function Indicators and the Elapsed Time for the current measurement period. An example of the summary diagram is shown below.



Online Help Window

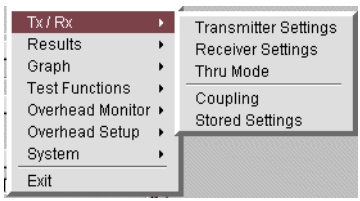
The instrument has a comprehensive built in help system. This is accessed at any time by pressing **<Help>**. To close the help just press **<Help>** again. The online help is displayed in a full size window.



NOTE The **<Help>** button toggles the display between the online help and the instrument windows – when you go back into online help it will be in the same page as when you left it.

Menus

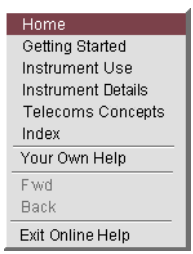
All instrument pages are accessed through the instrument's menu system by selecting an item from the menu. To display the main menu press **<Menu>**.



The focus will be on the first menu item and the submenu will also be displayed. As you move the focus down the menu, the submenu will automatically be displayed.

To select an item from the menu use the up/down arrow navigation buttons to move the focus through the main menu and the left/right arrow navigation buttons to move in and out of the submenus. To select a menu item press **<Select>**.

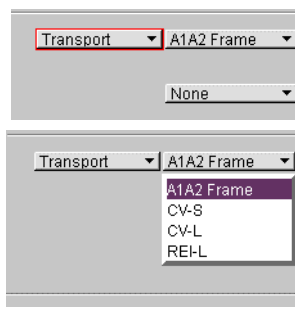
A menu is also available in the online help system to allow you to quickly navigate through the help system and provides quick access to the index and your own help files. To display, press **<Menu>**, while in online help.



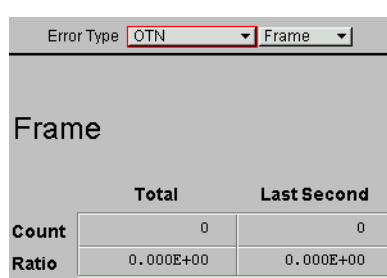
Basic User Interface Operations

To use a

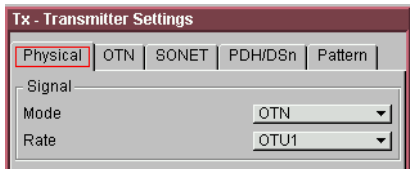
- **Drop down list box** – move the highlight onto the control field and press **<Select>**. Use the arrow navigation buttons to highlight your choice, then press **<Select>**. To close the drop down list without making a selection press **<Cancel>**.



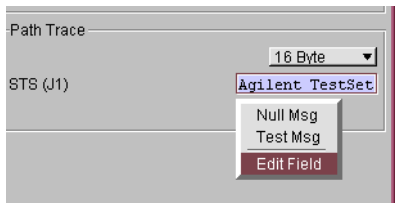
Drop down lists are used where multiple choices are available. For example, in the **Results > Errors** window you would first select the **Error Type** from the *two* drop down lists.



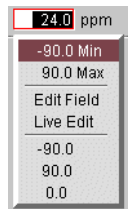
- **Folder/tab selector** – some windows have multiple pages within a window which are separated using folders/tabs. To select a folder/tab move the highlight onto it.



- **Text entry box** – move the highlight onto the control field. For quick text entry use the keypad which will be in text mode. (See "Keypad" on page 18 for details on how to use the keypad to enter text). Press **<Select>** to display a list of presets, **Edit Field** and a list of the most recently-used text.

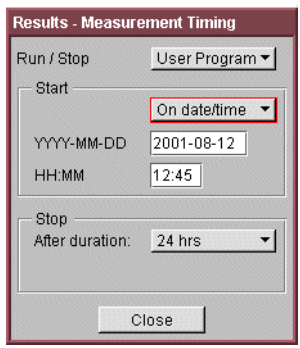


- **Numeric entry box** – move the highlight onto the control field. You can edit values using the keypad, Live Edit or Edit Field. Or you can choose from the preset or most recently-used values listed in the drop down menu. For quick numeric entry, use the keypad to enter the value, then press **<Select>** to save your entry. Alternatively, press **<Select>** to display a drop down list of min/max settings, **Edit Field**, **Live Edit** and a list of the most recently used values for that field.
  Edit Field allows you to select individual digits and edit them using the keypad. This is useful when you want to edit one digit of an eight digit number. Press **<Select>** to enter the value. Each time you enter a new value, the focus moves to the right.
  Live Edit allows you to increment or decrement a value during a measurement, using the arrow navigation keys. Use the left/right arrow keys to highlight the digit to be changed and use the up/down arrow keys to increase or decrease the value.



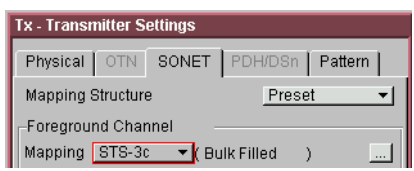
- **Action Buttons** – These are used to process an action. For example, in Pointer Adjustment, to action a pointer burst you would move the highlight to the **Transmit Pointer Burst** button and press **<Select>**.

- **Modal window** – a modal window is used when some action is required on certain settings. For example when setting up Measurement Timing - the Measurement Timing modal window will be displayed for you to set up the timing. You must then select **Close** to close the window. The **<Cancel>** button can also be used to quickly close the window - please note that this does NOT cancel any changes or settings you have made.

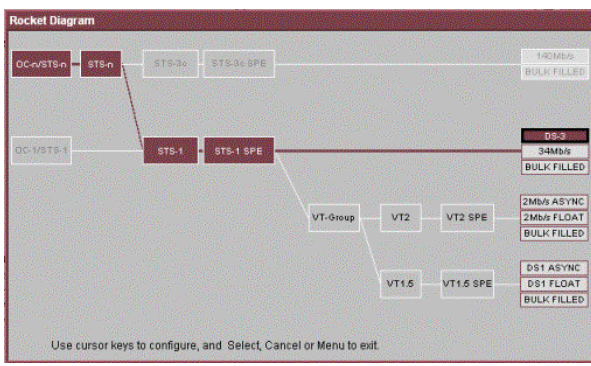


- **More** button – this is indicated by three dots and is used to indicate that there is more selection available. To use this move the highlight to the button and press **<Select>**.

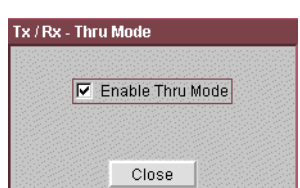
For example, in the mapping setup in the **Transmitter Settings** pages, select the **More** button to open the mapping diagram.



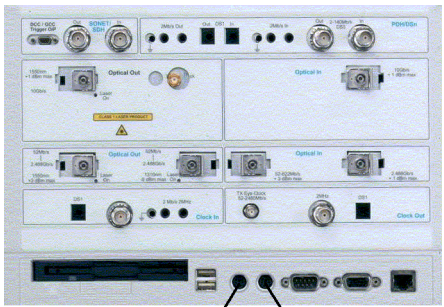
- **Mapping Diagram** – this is used to select a mapping structure. Use the arrow navigation keys to select the required mapping. Press **<Select>** when you have finished, or press **<Cancel>** to close the mapping diagram without changing the settings. An example of a mapping diagram is shown below.



- **Checkboxes** – these are used to set a control either OFF or ON. For example, to enable Thru Mode move the highlight to the checkbox and press **<Select>**.



Using a Mouse and Keyboard



You can connect a mouse and keyboard to the instrument. The connectors are described on “Side Panel Tour” on page 22.

The mouse allows you to point and click instead of using the arrows and **<Select>** key to select instrument settings on the display. Use the right mouse button to show the functions associated with pressing **<Menu>**.

You can use an external keyboard instead of the front panel keyboard to enter data. The keyboard can be connected to the instrument at any time.

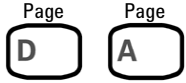
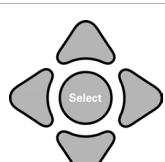
NOTE If you connect the keyboard to the mouse port, the keyboard will not function. Reconnect the keyboard and mouse to the correct ports and restart the instrument.

4
Using Online Help

The Online Help provides you with full information on how to set up and use the instrument. A comprehensive index and glossary are included.

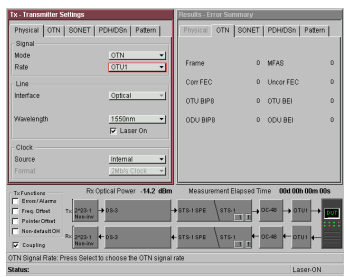
One of the main features of the instrument is the ability to add your own help files. This chapter tells you how to do this.

Which Keys Do I Press?

	Press this when you need to refer to the online help. Press it again to take you back to the instrument settings.
Home 	Returns you to the Home page.
Back Fwd 	The **<Back>** and **<Fwd>** keys are used the same way as in a typical Web browser - Use the **<Back>** key to go back to the previous page and, if you have just used the **<Back>** key for navigating then the **<Fwd>** key takes you forward to where you have come from.
Next Page Prev Page 	These key are used in the same way as Page Up and Page Down on your PC. When there is more information on a page than can be viewed at any one time, use the **<Prev Page>** and **<Next Page>** keys to scroll the display.
	Pressing **<Menu>** displays a drop-down list of the main contents of the online help. Use the Arrow keys to highlight what you want to view, then press **<Select>**.
	Most of the pages of online help have several links to more information. The link that is currently active is highlighted. To follow the link, just press the **<Select>** key.
	If the link you want to follow is not highlighted, use the **<Arrow Navigation>** buttons to highlight what you want to view, then press **<Select>**.

Context-Sensitive Help

A single line of text appears at the bottom of the display. This gives you helpful advice relating to the area of the screen that is highlighted by the red box.



< Context-Sensitive Help Message

Accessing the Index

To find information quickly on a particular topic press **<Menu>** and select **Index** when in Help mode.

Adding and Using Your Own Help Files

One of the benefits of this instrument is that you can add your own help files to the instrument and access them through the Online Help system. This may be a useful tool if you wish to store specific instructions for your technicians to carry out routine procedures, help them with problem solving, or detail test procedures that they should follow.

Accessing Your Own Help Files

To access your own help files that you have installed on the instrument, press **<Help>** then **<Menu>** on the instrument front panel, and select **Your Own Help**.

The names of your own help files will then be displayed as a list of links. To access a particular file, move the focus on to the link and press **<Select>**.

Create Your Own Help Files

The help files you create to install on the instrument must be in HTML format. You can create them using an HTML editor tool, or with a word processor that will save them as HTML files. When creating your files for online use follow these simple guidelines:

- Use only a sans serif type font of size 12, 14 or 16 point, Normal or Bold - DO NOT use italic as this font is not supported on the instrument and can cause problems with the presentation of your document.
- Any images you include should be either GIF or JPEG.
- Write several short documents rather than one long one. A long document takes longer to open.
- Design a page size and layout that's appropriate for the size of the instrument display.
- Have all the documents and images in one folder/directory. The instrument does not currently support file tree structures.
- Total size of the files should not be more than 1.44Mb.

CAUTION The instrument supports HTML Standard 3.2 - presentation or operation of elements using later HTML standards are not guaranteed to operate or display on the instrument.

The following procedure was used to create the example help files that are installed in the instrument - you can view the results on the online help in the 'Users Own Help Files' section.

NOTE The example help files can be copied from the instrument and amended for your own use. See "Copy Your Own Help Files to Disk" on page 47.

1. A standard word processor was used to create the content. Keeping your document short, two pages or so, will make it quicker to load and navigate when on the instrument.
2. Save the document as HTML with the file extension html NOT htm.
3. You can open your HTML file in a Web browser to check your converted file.

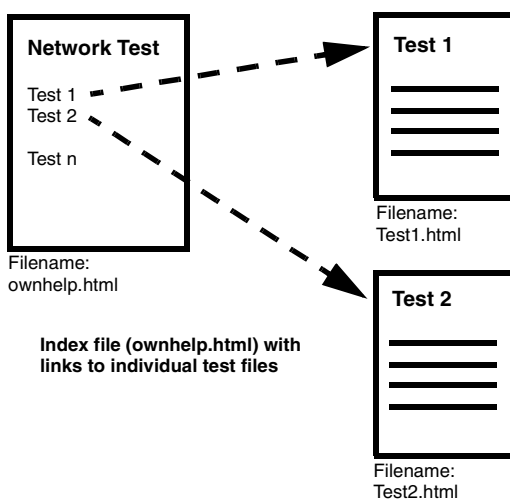
TIP: When saving your files, give them a meaningful name as it is this filename that will appear as a link in the index file online. For example 'AtlantaBasinTest5.html'.

4 When you have finished creating your HTML files you must now create an index file with links to each of your HTML files.

5 To do this, open a new file and create a hypertext link from this file to each of your help files.

6 Save the document as HTML. You must name this index file ownhelp.html. It is important that you use this name as it is used to access your files within the instrument.

7 Copy all of your HTML files, along with any image files that have been created, onto a floppy disk which you now need to install on the instrument.



Install/Update Your Own Help Files

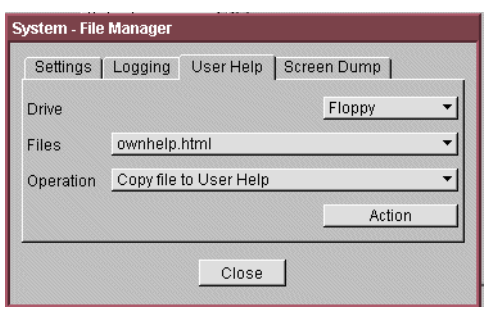
Add the files to the instrument by downloading them from a floppy disk.

NOTE

Your files must all have the extension html, with images as jpg or gif. Remember, your main index file must be named 'own-help.html' and be loaded into the instrument in order for the links to operate.

1 Insert the floppy disk into the disk drive on the left side of the instrument.

2 Press **<Menu>** and select **System > File Manager.**



3 Select the **User Help** folder as shown above.

4 Set the **Drive** field to **Floppy**.

5 Select the **Operation** field and choose **Refresh List**. Move the focus to the **Action** field and press <Select> to refresh the list of files.

6 Select the Operation field and choose **Copy all files to User Help**.

7 Move the focus to the **Action** button and press **<Select>**. Your files will now be copied from the floppy disk to the instrument.

To update files you have already installed in the instrument, repeat the steps 1 to 7, but for step 7 Select the **Operation** field and choose **Copy file to User Help** - you can then select the update file you want to install.

NOTE When adding files to the instrument any files with the same name will be overwritten and new files will be added.

8 To check that you can access the files, press **<Help>,** then **<Menu>** on the instrument panel, and select **Your Own Help**.

Copy Your Own Help Files to Disk

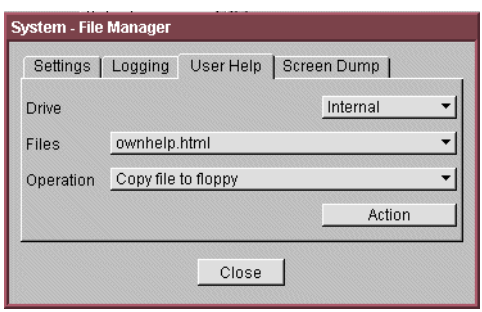
To copy files from the instrument to a floppy disk:

1 Insert a floppy disk into the disk drive on the left side of the instrument.

2 Press **<Menu>** and select **System > File Manager.**

3 Press **<Select>** to open the File Manager window.

4 Select the **User Help** folder as shown.



5 Set the **Drive** field to **Internal**.

6 Select the **Operation** field, press **<Select>** and choose **Refresh List**. Move the focus to the **Action** field and press **<Select>** to refresh the list of files.

7 Select the **Files** field and choose a file.

8 Select the **Operation** field and choose **Copy file to floppy** or **Copy all files to floppy** as required.

9 Move the focus to the **Action** button and press **<Select>**.

Your files will now be downloaded from the instrument to the floppy disk.

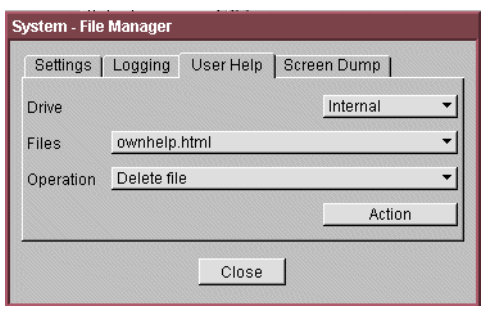
Delete Your Own Help Files

You can use File Manager to delete User Help files stored internally or on a floppy disk.

1 Press **<Menu>** and select **System > File Manager.**

2 Press **<Select>** to open the File Manager window.

3 Select the **User Help** folder as shown.



4 Set the **Drive** field to **Internal** or **Floppy** as required.

5 Select the **Operation** field, press **<Select>** and choose **Refresh List**. Move the focus to the **Action** field and press **<Select>** to refresh the list of files.

6 Select the **Files** field and choose the file you wish to delete.

7 Select the **Operation** field and choose **Delete file** or **Delete all files** as required.

8 To delete the file/files select the **Action** field and press **<Select>**.

5
Using Smart Test and SignalWizard

You can use Smart Test to access the SignalWizard feature or to reset the instrument to its default settings. Smart Test also provides shortcuts to results, measurements and stored settings.

To access Smart Test features:

Press **<Smart Test>** then select the appropriate feature from the drop-down menu using the arrows and **<Selects>** keys.

Shortcuts to Results, Measurements and Stored Settings

You can use Smart Test to access results, measurements and stored settings.

To access shortcuts:

1 Press **<Smart Test>** then select **Shortcuts** using the arrows and **<Select>** keys.

2 Select the required shortcut from the list.

Resetting Instrument to Default Settings

You can use the Smart Test to reset the instrument to its default values.

To reset instrument to default settings

1 Press **<Smart Test>** then select **Reset Instrument** using the arrows and **<Select>** keys.

2 Select **OK** in the "Warning" window to reset the instrument settings.

Using the SignalWizard Test Feature

SignalWizard checks the test ports for valid OTN/SONET/SDH signals. A signal is valid if its power level and frequency are with in the specified limits of the port it is connected to. For each valid signal it then determines the line rate and interface level for optical signals, and determines the termination, signal level and line coding for electrical signals.

SignalWizard then scans all STS/AU channels (up to 192) and selected 'expanded' VT/TU channels simultaneously for error and alarm information. For VT/TU channels that are not 'expanded' in the display, error and alarm information is obtained sequentially (within milliseconds).

SignalWizard can also scan PDH/DSn sub-channels, and shows which channels are unequipped and the type of service being carried by equipped channels.

For information on connecting to a network when testing with SignalWizard, see:

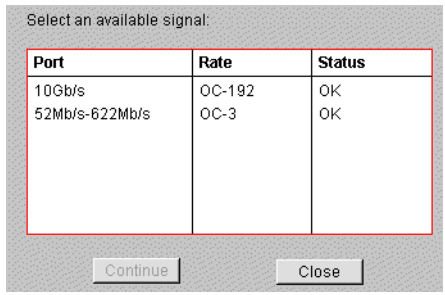
- "In-Service Testing" on page 58
- "Out-of-Service Testing" on page 59

To monitor a signal with SignalWizard:

1 Press **<Smart Test>**, then select **SignalWizard**. A progress indicator is displayed. If more than one valid signal is detected, the port selection window is displayed. Select the port you want to examine, then select **Continue**. If only one valid signal is detected or if the instrument is in Thru-Mode, the channel Overview window is displayed.

   If SignalWizard detects a DSn/PDH signal, then **PDH/DSn Channel Scan** will automatically be launched. A window will appear showing the status and structure of all channels.

   If no valid signal is detected, you can re-scan the ports or return to the main instrument.

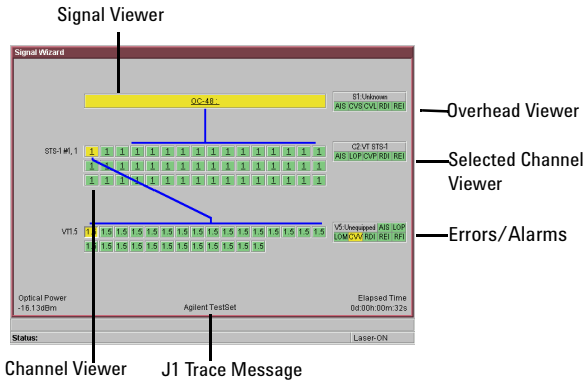


2 Press **<Menu>** to further investigate channels, errors or path trace messages (select **Next Error**, **Previous Error**, **Expand** or **Collapse**). For information, see "Understanding SignalWizard Overview Window" on page 53. If any STS/AU contains VT/TU tributaries, you can view a tributary in more detail. Select the channel, press **<Menu>**, then select **Expand**. For information on path trace messages, see "Monitoring Path Trace Messages" on page 56.

   You can also manually start the **PDH/DSn Channel Scan** from the menu.

3 Press **<Menu>** then select **Exit**, or press **<SignalWizard>** then select **Stop Wizard** to close SignalWizard. Or before closing SignalWizard, you can automatically configure the transmitter and/or receiver settings to match the signal being applied to the instrument (not available in Thru mode). This feature is useful if you intend doing further testing, it saves you from having to manually configure the instrument settings.

Understanding SignalWizard Overview Window



Signal Viewer

Displays the detected signal. If a J0 trace message is detected this is also displayed (both 16- and 64-byte message formats are supported).

Overhead Viewer

Displays results information associated with the overhead layer of the signal, including:

- Synchronization status message (decoded S1 byte)
- Transport/Section overhead error status
- Transport/Section overhead alarm status

(LOS and LOF alarms are displayed on the instrument's front panel LEDs.)

Selected Channel Viewer

Displays result information associated with the selected channel, including:

- Type of payload (traffic) being carried in the channel (decoded C2 byte)
- Path error status
- Path alarm status
- Indicator for detected pointer adjustments

J1 Trace Message

Displays the decode path trace message associated with the selected channel. Both 16- and 64-byte messages formats are supported.

Channel Viewer

The Overview window shows a summary (using color coding, see the following table) of the results for all channels. Each channel detected in the signal is provided with a dedicated box that summarizes the channel status. A channel carrying VT/TU channels is highlighted by its size designator being underlined. Broadband mappings are not underlined.

The size designator displayed within each box is the channel size identifier. While any non-standard concatenated channels will be detected and displayed, no errors or alarms are reported for that channel. Unequipped channels are displayed on a gray background.

Pointer activity within a channel is indicated by the channel background flashing blue.

Color Coding		Result
Green		No errors/alarms detected during test
Red		Errors/alarms detected during last test period
Yellow		Currently error/alarm free but errors/alarms detected earlier in test period
Blue		Pointer movement in last test period
Red (yellow A)		Current AIS (STS-1, STS-3c/STM-0, STM-1)
Gray		Unequipped
Black		Illegal

Errors

For each channel B3 and REI-P errors are monitored. Two flags, one momentary and one latched, are set if one or more errors are discovered in any interval.

Alarms

For each channel a flag is set for each of the alarms if it is present during the interval.

- Loss of Pointer LOP
- Path AIS (AIS-P)
- Remote Path Alarm (RDI-P)
- Pointer Adjustment LOP (LOP flashes blue on each adjustment)

Monitoring Path Trace Messages

Once you have run SignalWizard and with the Overview window displayed, you can identify routing errors within a network.

During the installation and commissioning of new services, or troubleshooting, the ability to generate and monitor path trace messages is essential. This allows you to confirm correct routing paths through network equipment with software controlled routing capability. You can also use path trace messages for checking routing performance of network elements during protection switching to confirm the correct signals have been protected in fault conditions.

You can view all the J1 path trace messages for the received signal at the same time. Or, you can view all the J2 path trace messages associated with VT/TU channels in a selected STS/AU.

To view path trace messages:

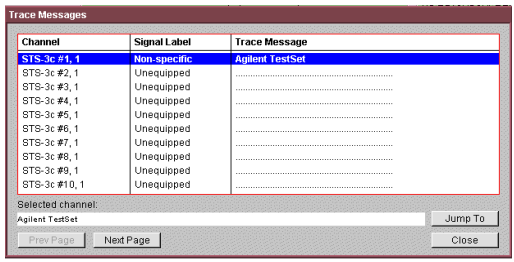
- Using the arrow navigation keys select the STS/AU channel of interest and view its J1 path trace message at the bottom of the display.

To search all J1 Path trace messages in the receive signal:

- Press **<Menu>,** select **Trace Messages** then select **List Current Levels**, a trace message window will be displayed.

  or

- Press **<Menu>**, select **Trace Messages** then select **Search Current Level**. Enter the trace message you are searching for in the dialog box, then select **OK**.



To view J2 Path trace messages in VT/TU channel:

NOTE STS/AU channels that contain VT/TU channels are shown underlined on the display.

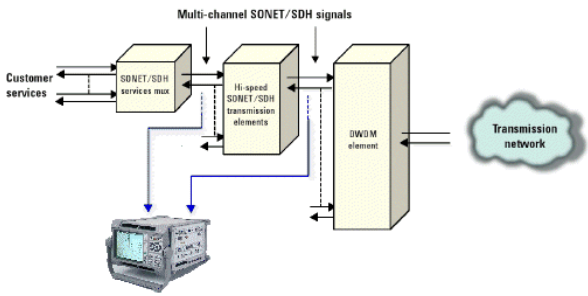
1 Use the arrows to highlight the channel for further analysis.

2 Press **<Menu>** then select **Expand**.

3 Press **<Menu>** then select **Collapse** to close the VT/TU substructure.

In-Service Testing

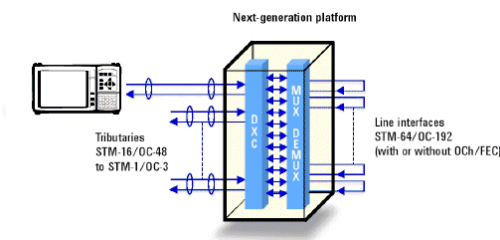
You can use SignalWizard to simultaneously monitor all channels in the received signal. This feature is useful when commissioning new transmission systems or performing routine maintenance checks. A typical in-service network test connection is shown below.



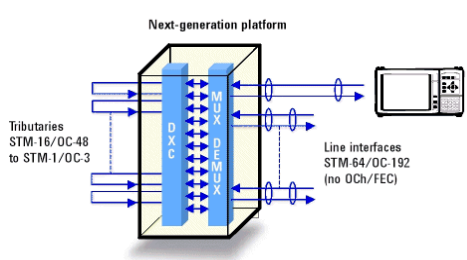
Out-of-Service Testing

You can use the Transmission Test Set transmitter in conjunction with SignalWizard all channel test feature to test each path carried within a tributary or line signal. You can apply the test signal to the tributary or line side of the network element.

Applying a test signal to the line side of the network element may reduce the number of ports that need to be checked. SignalWizard will identify the type of network paths present in the received signal (including the mix of channel types), and the traffic carrying status of each channel (showing which are equipped). Typical tributary and line network test connections are shown below.



Tributary-Side Testing Setup



Line-Side Testing Setup

5 Using Smart Test and SignalWizard

6 Measurement Tutorial - OTN

This Chapter takes you through the steps you should follow to set up a typical bit error rate (BER) measurement.

Measuring Bit Error Rate

The bit error rate (BER) test is one of the simplest and most effective ways to measure the quality of a transmission link. You can use the instrument to make a BER test on a two-way link that is connected in loop-back configuration.

Measurement Setup

The following procedure shows how to use the instrument controls and arrow navigation buttons to set up and perform a measurement.

In this procedure you will configure the instrument to transmit and receive an OTU2 optical signal with a SONET payload containing an STS-192c bulk filled payload.

Measurement test timing is set to be started and stopped manually, and errors and alarms are inserted into the transmitted signal to confirm that the instrument receiver measures and displays those conditions. In this procedure the instrument transmitter output is connected directly to the receiver input. Under normal operating conditions the instrument transmitter output would be connected to a system under test and the output from the system connected to the instrument receiver input.

For information on good practises used when connecting to optical interfaces please refer to “Avoiding Optical Receiver Overload” on page 99 and “Avoiding Problems When Making Measurements” on page 98.

1. Check the instrument’s **Optical Out** ports and ensure that all **Laser On** LEDs are Off. There should also be a **Laser-OFF** message on the instrument **Status** line (bottom of display).
2. Before making any connections to the receiver **Optical In** ports always check the input power level on a Power Meter.
3. On the instrument connect the **9.95/10.71 Gb/s Optical Out port** to the receiver **9.95/10.71 Gb/s Optical In port** through a 15 dB attenuator.

Set Up Transmitter

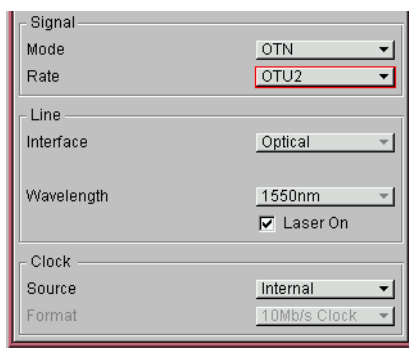
Set up the instrument transmitter as follows:

4 Press **<Menu>** and select **Tx/Rx > Transmitter Settings**, then press **<Select>**.

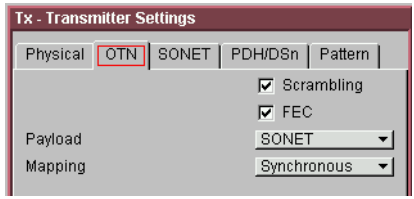
5 Select the **Physical** tab.

6 Select the **Signal Mode** field and press **<Select>** to reveal a drop down menu of the available signal types. Use the arrow navigation keys to highlight **OTN**, then press **<Select>.** Select **OTU2** as the **Signal Rate**.

Set up the **Clock Source** field as below. For safety, only turn laser on after the fiber has been connected to the transmitter. Check the **Status** line for any warnings of optical power overload.

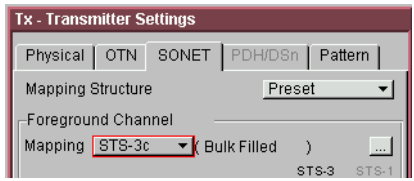


7 Move the cursor focus to the top of the Transmitter Settings window and select the **OTN** tab.

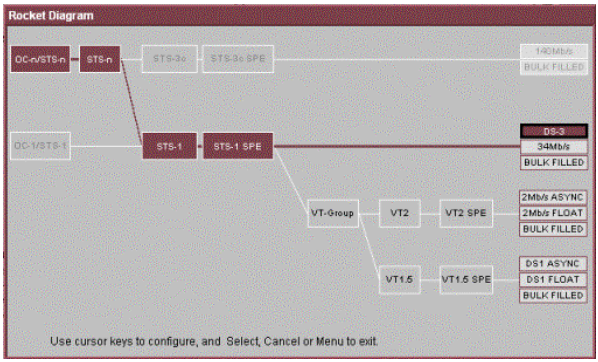


8 Move the cursor to the **Scrambling** field and press **<Select>**. This places a tick in the box and turns scrambling on. Move the cursor to the **FEC** box and place a tick in this box to turn forward error correction on. In the **Payload** field press **<Select>** and then select SONET from the drop down menu. Select the **Mapping** to be **Synchronous**.

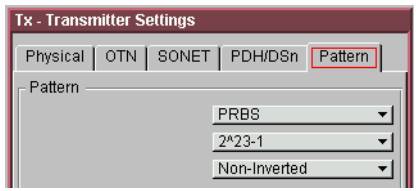
9 Move the cursor focus to the top of the Transmitter Settings window and select the **SONET** tab.



10 In the **Mapping Structure** field press **<Select>** and choose **Preset**. In the **Foreground Channel Mapping** field, select the mapping from the drop-down box and, if the **More** button is shown press **<Select>** to display the mapping diagram. You can then select the payload mapping using the navigation arrows and **<Select>** key.



11 Move the cursor focus to the top of the Transmitter Settings window and select **Pattern**. Set up **Payload Pattern** as shown below.

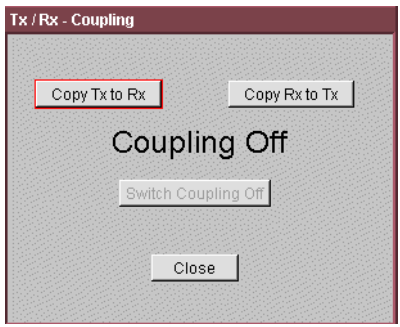


Couple Tx and Rx

To ensure the receiver has the same setting as the transmitter:

12 Press **<Menu>** and select **Tx/Rx > Coupling**.

13 Press **<Select>** to open the Coupling window.



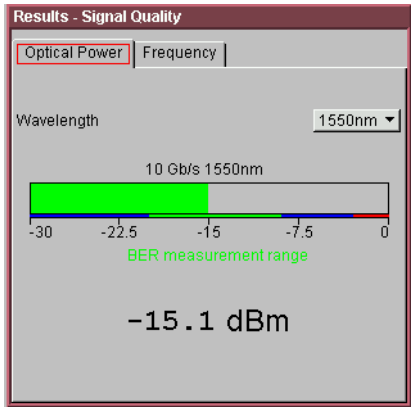
14 If Coupling is **ON** proceed to step 18. If it is **OFF** (indicated as shown above), proceed to step 15.

15 Select **Copy Tx to Rx** (this selection copies Transmitter settings into the Receiver) and press **<Select>**. Move the cursor to **Close** then press **<Select>** to exit the Coupling window.

Check Receiver Input Power

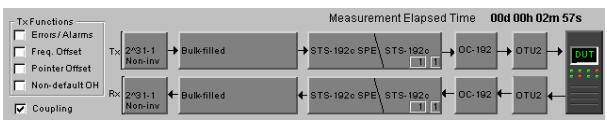
16 Check the **Status** line at the bottom of the display for any warning messages and check Receiver Input Power as follows.

17 Press **<Menu>** and select **Results > Signal Quality** and check the Receiver Input Power. An example is given on the next page.



Check Setup

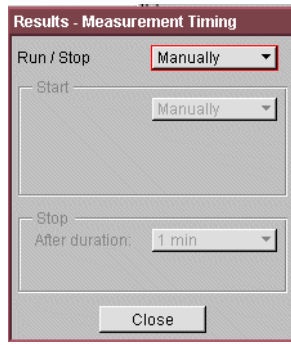
The Transmitter and Receiver settings should now be identical. You can check this by viewing the instrument Summary window at the bottom of the display. As well as giving setup status information, this field displays how the signal paths in the transmitter and the receiver are set up.



Set Measurement Gating

18 Press **<Menu>** and select **Results > Measurement Timing**.

19 Press **<Select>** to open the Measurement Timing window.



20 Set the measurement **Run/Stop** to **Manually**. Setting both to manually ensures that testing is controlled via the green **<Run/Stop>** button on the instrument front panel.

21 Use the navigation arrows to select **Close**, then press **<Select>** to close the window.

Start Measurement

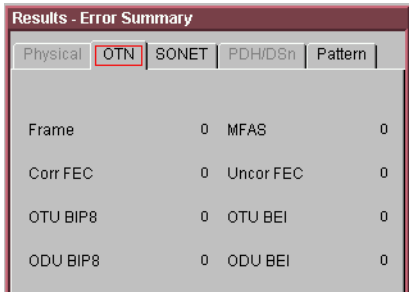
22 Press the front panel **<Run/Stop>** button to start the measurement.

23 The measurement will continue until you end the measurement gating period by pressing **<Run/Stop>**. Leave the instrument continuously gating.

View Results

24 To view results press **<Menu>** and select **Results > Error Summary**.

25 Press **<Select>** to open the Error Summary window.



26 Check that there are no errors displayed.

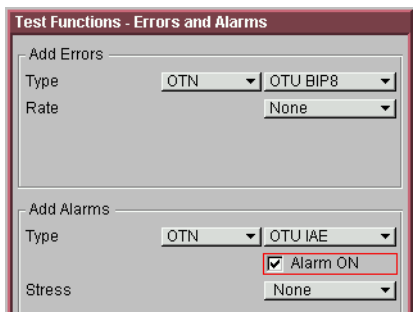
27 To confirm that the instrument is measuring correctly, add errors and alarms to the output signal as follows:

Add Single Errors and an Alarm to Tx Output

28 Press **<Menu>** and select **Test Functions > Errors and Alarm Generation**.

29 Press **<Select>** to open the Errors and Alarms window.

30 Use the navigation arrows to set up errors and alarms as shown.



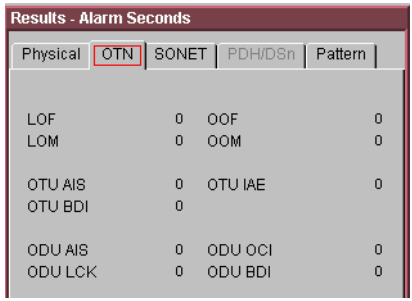
Add a Single Error

- Press the front panel **<Single Error>** button (gray in color) a number of times. Select the **<Run/Stop>** button. Check that with each button press the OTU BIP8 error count in the **Error Summary** results page increments. Try selecting other Error Types and Error Rates and observe the change to the results displayed.

View Alarm Results

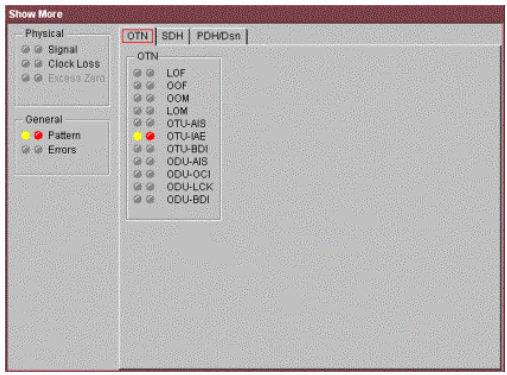
31 Press **<Menu>** and select **Results > Alarm Seconds**.

32 Press **<Select>** to open the **Alarm Seconds** window.



33 Check that the OTU-IAE alarm seconds count is incrementing, and that the front panel OTN LED alarm indicator is on (OTN-IAE alarm enabled in "Add Single Errors and an Alarm to Tx Output" on page 70).

34 Press the front panel **<Show More>** button (blue color) to see details of current and historical errors/alarms. Current errors/alarms are shown red, historical ones are shown yellow.



35 Press the front panel **<Run/Stop>** button to stop the measurement.

End of Tutorial.

7 Measurement Tutorial - SONET

This Chapter takes you through the steps you should follow to set up a typical bit error rate (BER) measurement.

Measuring Bit Error Rate

The bit error rate (BER) test is one of the simplest and most effective ways to measure the quality of a SONET transmission link. You can use the instrument to make a BER test on a two-way link that is connected in loop-back configuration.

Measurement Setup

The following procedure shows how to use the instrument controls and arrow navigation buttons to set up and perform a measurement.

In this procedure you will configure the instrument to transmit and receive an OC-12 optical signal with an STS-3c SPE payload containing a 2^23-1 PRBS test pattern. Measurement test timing is set to be started and stopped manually, and errors and alarms are inserted into the transmitted signal to confirm that the instrument receiver measures and displays those conditions. In this procedure the instrument transmitter output is connected directly to the receiver input. Under normal operating conditions the instrument transmitter output would be connected to a system under test and the output from the system connected to the instrument receiver input.

For information on good practises used when connecting to optical interfaces please refer to “Avoiding Optical Receiver Overload” on page 99 and “Avoiding Problems When Making Measurements” on page 98.

1. Check the instrument’s **Optical Out** ports and ensure that all **Laser On** LEDs are Off. There is also a **Laser-OFF** message on the instrument **Status** line (bottom right of display).
2. Before making any connections to the receiver **Optical In** ports always check the input power level on a Power Meter.
3. On the instrument, connect the **52-2.5 Gb/s Optical Out port** (1310 or 1550 nm depending on options fitted to your instrument) to the receiver **52-622 Mb/s Optical In port** through a 15 dB attenuator.

Set Up Transmitter

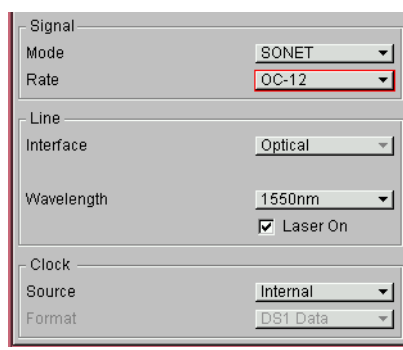
Set up the instrument transmitter as follows:

4 Press **<Menu>** and select **Tx/Rx > Transmitter Settings**, then press **<Select>**.

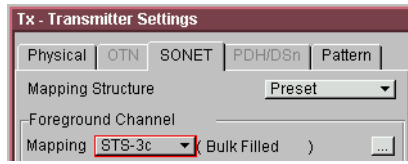
5 Select the **Physical** tab.

6 Select the **Signal Mode** field and press **<Select>** to reveal a drop down menu of the available modes of operation of the instrument. Use the navigation arrows to highlight **SONET**, then press **<Select>.** In the **Signal Rate** field select **OC-12**.

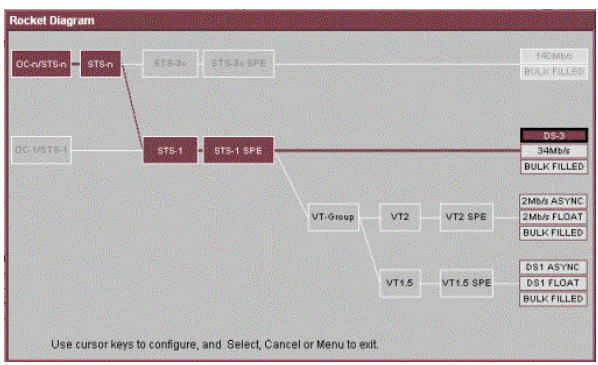
Use the navigation arrows to set up the other Transmitter fields, **Line** (includes Wavelength and Laser On/Off selection, set Laser to **On**), and **Clock** Source as shown below. For safety, only turn laser on after the fiber has been connected to the transmitter. Check the Status line for any warnings of optical power overload.



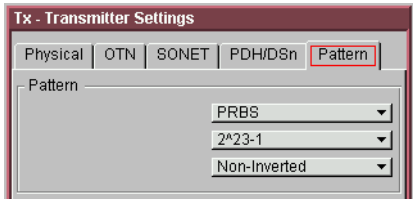
7 Move the cursor focus to the top of the Transmitter Settings window and select the **SONET** tab.



8 In the **Mapping Structure** field press **<Select>** and choose **Preset**. In the **Foreground Channel Mapping** field, select the mapping from the drop-down box and, if the **More** button is shown press **<Select>** to display the mapping diagram. You can then select the payload mapping using the navigation arrows and **<Select>** key.



9 Move the cursor focus to the top of the Transmitter Settings window and select **Pattern**. Set up **Payload Pattern** as shown below.

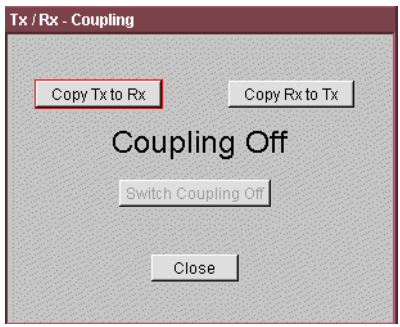


Couple Tx and Rx

To ensure the receiver has the same setting as the transmitter:

10 Press **<Menu>** and select **Tx/Rx > Coupling**.

11 Press **<Select>** to open the Coupling window.



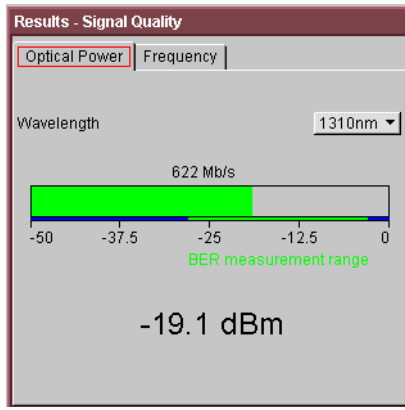
12 If Coupling is **ON** proceed to step 16. If it is **OFF** (indicated as shown above), proceed to step 13.

13 Select **Copy Tx to Rx** (this selection copies Transmitter settings into the Receiver) and press **<Select>**. Move the cursor to **Close** then press **<Select>** to exit the Coupling window.

Check Receiver Input Power

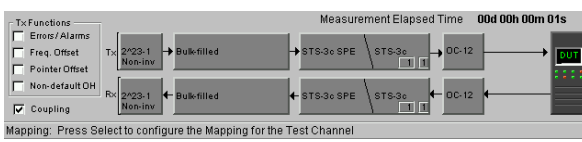
14 Check the **Status** line at the bottom of the display for any warning messages and check Receiver Input Power as follows.

15 Press **<Menu>** and select **Results > Signal Quality** and check the Receiver Input Power. An example is given on the next page.



Check Setup

The Transmitter and Receiver settings should now be identical. You can check this by viewing the instrument Summary window at the bottom of the display. As well as giving setup status information, this field displays how the signal paths in the transmitter and the receiver are set up.



Set Measurement Gating

16 Press **<Menu>** and select **Results > Measurement Timing**.

17 Press **<Select>** to open the Measurement Timing window.

18 Set the measurement **Run/Stop** to **Manually**. Setting both to manually ensures that testing is controlled via the green **<Run/Stop>** button on the instrument front panel.

19 Use the navigation arrows to select **Close**, then press **<Select>** to close the window.

Start Measurement

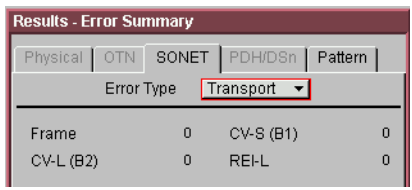
20 Press the front panel **<Run/Stop>** button to start the measurement.

21 The measurement will continue until you end the measurement gating period by pressing **<Run/Stop>**. Leave the instrument continuously gating.

View Results

22 To view results press **<Menu>** and select **Results > Error Summary**.

23 Press **<Select>** to open the Error Summary window.



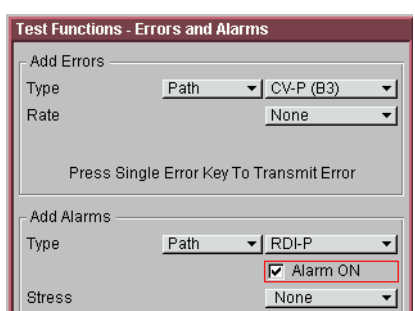
24 Check that there are no errors displayed.

25 To confirm that the instrument is measuring correctly, add errors and alarms to the output signal as follows:

Add Single Errors and an RDI-P Alarm to Tx Output

26 Press **<Menu>** and select **Test Functions > Errors and Alarms**.

27 Press **<Select>** to open the Errors and Alarms window.



28 Use the navigation arrows to set up errors and alarms as shown.

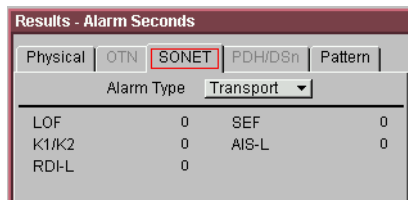
Add a Single Error

29 Press the front panel **<Single Error>** button (gray in color) a number of times. Select the **<Run/Stop>** button. Check that with each button press the CV-P error count in the **Error Summary** results page increments. Try selecting other Error Types and Error Rates and observe the change to the results displayed.

View Alarm Results

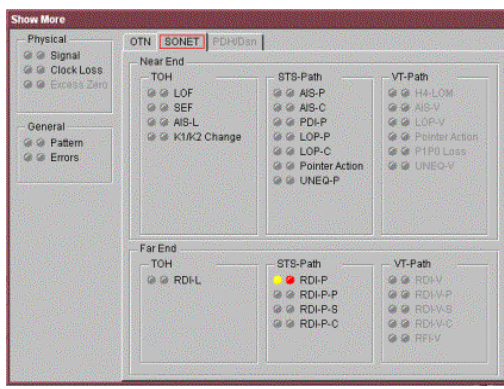
30 Press **<Menu>** and select **Results > Alarm Seconds**.

31 Press **<Select>** to open the **Alarm Seconds** window.



32 Check that the RDI-P alarm seconds count is incrementing, and that the front panel SONET/SDH LED alarm indicator is on (RDI-P alarm enabled in step 28).

33 Press the front panel **<Show More>** button (blue color) to see details of current and historical errors/alarms. Current events are shown red, historical ones are shown yellow.



34 Press the front panel **<Run/Stop>** button to stop the measurement.

End of Tutorial.

7 Measurement Tutorial - SONET

8 Measurement Tutorial - SDH

This Chapter takes you through the steps you should follow to set up a typical bit error rate (BER) measurement.

Measuring Bit Error Rate

The bit error rate (BER) test is one of the simplest and most effective ways to measure the quality of an SDH transmission link. You can use the instrument to make a BER test on a two-way link that is connected in loop-back configuration.

Measurement Setup

The following procedure shows how to use the instrument controls and arrow navigation buttons to set up and perform a measurement.

In this procedure you will configure the instrument to transmit and receive an STM-4 optical signal with an AU-4-4c payload containing a 2^23-1 PRBS test pattern. Measurement test timing is set to be started and stopped manually, and errors and alarms are inserted into the transmitted signal to confirm that the instrument receiver measures and displays those conditions. In this procedure the instrument transmitter output is connected directly to the receiver input. Under normal operating conditions the instrument transmitter output would be connected to a system under test and the output from the system connected to the instrument receiver input.

For information on good practises used when connecting to optical interfaces please refer to “Avoiding Optical Receiver Overload” on page 99 and “Avoiding Problems When Making Measurements” on page 98.

1. Check the Test Set **Optical Out** ports and ensure that all **Laser On** LEDs are Off. There should also be a **Laser-OFF** message on the instrument **Status** line (bottom of display).
2. Before making any connections to the receiver **Optical In** ports always check the input power level on a Power Meter.
3. On the instrument connect the **52-2.5 Gb/s Optical Out port** (1310 or 1550 nm depending on options fitted to your instrument) to the receiver **52-622 Mb/s Optical In port** through a 15 dB attenuator.

Set Up Transmitter

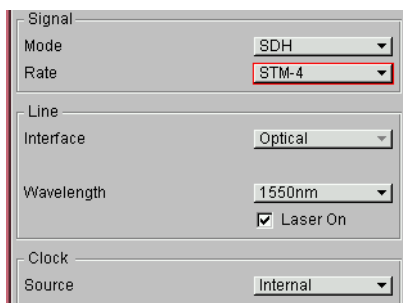
Set up the instrument transmitter as follows:

4 Press **<Menu>** and select **Tx/Rx > Transmitter Settings**, then press **<Select>**.

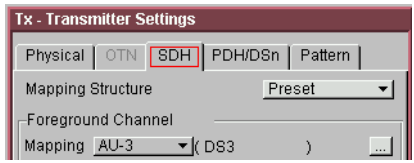
5 Select the **Physical** tab.

6 Select the **Signal Mode** field and press **<Select>** to reveal a drop down menu of the available modes of operation of the instrument. Use the navigation arrows to highlight SDH, then press **<Select>.** In the **Signal Rate** field select **STM-4**.

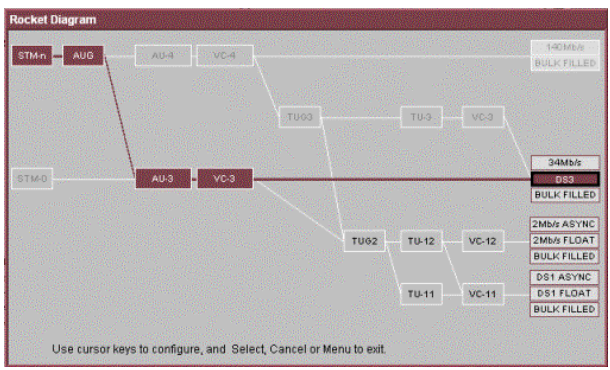
Use the navigation arrows to set up the other Transmitter fields, **Line** (includes Wavelength and Laser On/Off selection, set Laser to **On**), and **Clock** Source as shown below. For safety, only turn laser on after the fiber has been connected to the transmitter. Check the Status line for any warnings of optical power overload.



7 Move the cursor focus to the top of the Transmitter Settings window and select **SDH**.

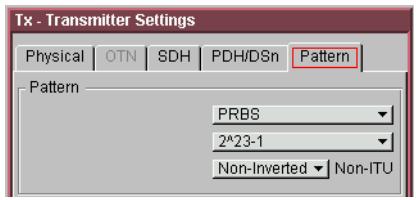


8 In the **Mapping Structure** field press **<Select>** and choose **Preset**. In the **Foreground Channel Mapping** field, select the mapping from the drop-down box and, if the **More** button is shown press **<Select>** to display the mapping diagram. You can then select the payload mapping using the navigation arrows and **<Select>** key.



9 Ignore the Tandem Connection Monitoring field selection for this measurement.

10 Move the cursor focus to the top of the Transmitter Settings window and select **Pattern**. Set up **Payload Pattern** as shown below.

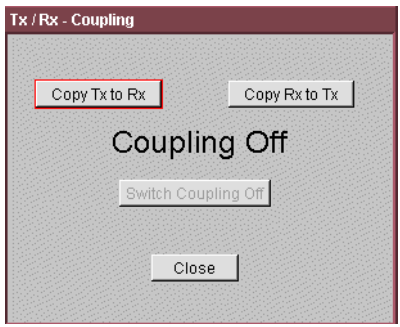


Couple Tx and Rx

To ensure the receiver has the same setting as the transmitter:

11 Press **<Menu>** and select **Tx/Rx > Coupling**.

12 Press **<Select>** to open the Coupling window.



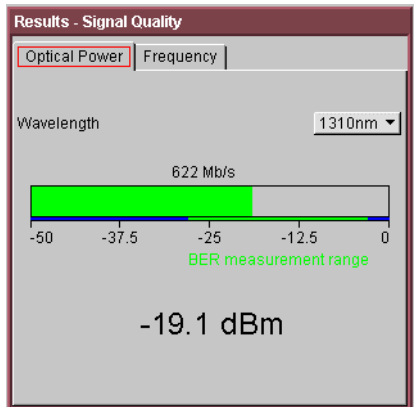
13 If Coupling is **ON** proceed to step 17. If it is **OFF** (indicated as shown above), proceed to step 14.

14 Select **Copy Tx to Rx** (this selection copies Transmitter settings into the Receiver) and press **<Select>**. Move the cursor to **Close** then press **<Select>** to exit the Coupling window.

Check Receiver Input Power

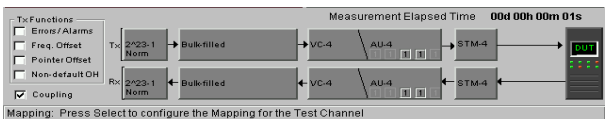
15 Check the **Status** line at the bottom of the display for any warning messages and check Receiver Input Power as follows.

16 Press **<Menu>** and select **Results > Signal Quality** and check the Receiver Input Power. An example is given on the next page.



Check Setup

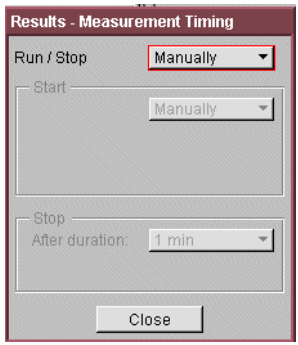
The Transmitter and Receiver settings should now be identical. You can check this by viewing the instrument Summary window at the bottom of the display.



Set Measurement Gating

17 Press **<Menu>** and select **Results > Measurement Timing**.

18 Press **<Select>** to open the Measurement Timing window.



19 Set the measurement **Run/Stop** to **Manually**. Setting both to manually ensures that testing is controlled via the green **<Run/Stop>** button on the instrument front panel.

20 Use the navigation arrows to select **Close**, then press **<Select>** to close the window.

Start Measurement

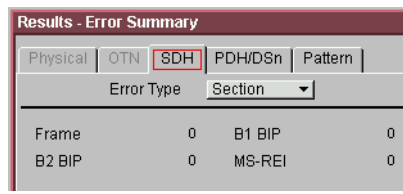
21 Press the front panel **<Run/Stop>** button to start the measurement.

22 The measurement will continue until you end the measurement gating period by pressing **<Run/Stop>**. Leave the instrument continuously gating.

View Results

23 To view results press **<Menu>** and select **Results > Error Summary**.

24 Press **<Select>** to open the Error Summary window.



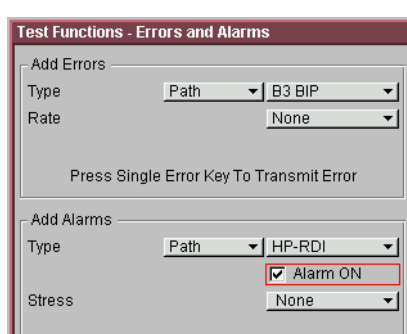
25 Check that there are no errors displayed.

26 To confirm that the instrument is measuring correctly, add errors and alarms to the output signal as follows:

Add Single Errors and an HP-RDI Alarm to Tx Output

27 Press **<Menu>** and select **Test Functions > Errors and Alarm Generation**.

28 Press **<Select>** to open the Errors and Alarms window.



29 Use the navigation arrows to set up errors and alarms as shown.

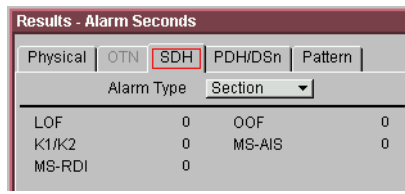
Add a Single Error

30 Press the front panel **<Single Error>** button (gray in color) a number of times. Select the **<Run/Stop>** button. Check that with each button press the B3 error count in the **Error Summary** results page increments. Try selecting other Error Types and Error Rates and observe the change to the results displayed.

View Alarm Results

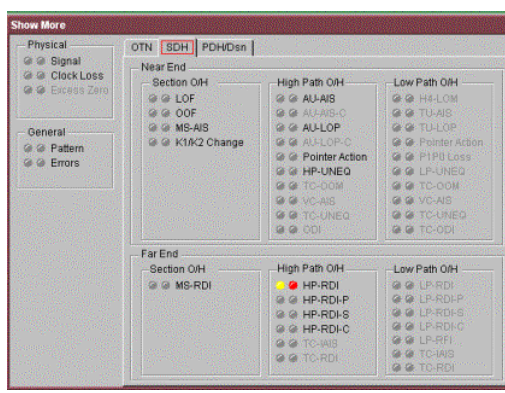
31 Press **<Menu>** and select **Results > Alarm Seconds**.

32 Press **<Select>** to open the **Alarm Seconds** window.



33 Check that the HP-RDI alarm seconds count is incrementing, and that the front panel SONET/SDH LED alarm indicator is on (HP-RDI alarm enabled in step 29).

34 Press the front panel **<Show More>** button (blue color) to see details of current and historical errors/alarms. Current events are shown red, historical ones are shown yellow.



35 Press the front panel **<Run/Stop>** button to stop the measurement.

End of Tutorial.

8 Measurement Tutorial - SDH

9
Hints and Tips

Avoiding Problems When Making Measurements

Bit errors that occur when the instrument is testing network equipment may be caused by a number of defects in the network. This can include faulty network elements, damaged optical fiber, particles of dust or dirt in the fiber connections, and so on.

However, often errors will be caused by other problems that are not the fault of the network. When testing, make sure that errors are not injected by the test environment. The following steps provide general advice on how to avoid introducing errors when performing tests.

- Ensure that optical fibers connecting the instrument to the network are not damaged - check that fibers have not been crimped.
- Avoid acute bends in the fiber. Ensure that fibers only have gentle arcs, to avoid causing errors.
- If the instrument is left unattended for a long term test, ensure that the equipment is not in a position where people will disturb the connecting fibers and cause bit errors.
- Ensure that all fiber connections are clean and dirt free. Cleanliness can be verified on a (unpowered) fiber with a fiberscope, and when connected to the network, with a power meter to ensure poor connections are not causing a drop in power. The instrument internal power meter can be used to verify this.
- Before connection is made, always clean the connector ferrule tip with acetone or alcohol and a cotton swab. Dry the connector with compressed air. Failure to maintain cleanliness of connectors is liable to cause excessive insertion loss. See “Cleaning Optical Connectors” on page 100.

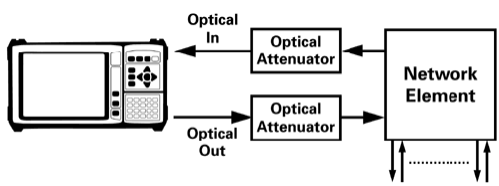
Avoiding Optical Receiver Overload

Check when connecting an optical transmitter to an optical receiver that you do not overload the receiver. This applies to elements under test and also the instrument receiver input ports.

On the instrument connector panel the following output/input power level information is printed:

Tx Optical Out ports: Maximum available output power.

Rx Optical In ports: Maximum input power (damage level) the receiver input can accept before damage occurs.



When performing tests, it is recommended that you drive the optical receiver with a signal that has an average power in the middle of the receiver's operating range.

Cleaning Optical Connectors

We recommend cleaning the optical connectors at regular intervals using the following materials:

Description	Agilent Part Number
Compressed Air Can or Blow Brush	
Isopropyl Alcohol	8500-5344
Lens Cleaning Paper	9300-0761
Swabs	5080-5400

CAUTION Do not insert any tool or object into the optical IN or OUT ports of the instrument as damage to or contamination of the optical fiber may result.

1. Disconnect the instrument from the Power Line or switch off the laser transmitter before commencing this cleaning procedure.
2. Remove the adapters from the optical IN and OUT ports by flipping back the lever on the optical adapter.
3. Using the blow brush with the brush removed blow through the ferrule of the standard flexible connector and the adapter.
4. If the optical fiber of the fixed connector requires further cleaning this entails disassembly of the module. This should be carried out only by suitably trained service personnel.
5. Apply some isopropyl alcohol to a piece of the cleaning paper and clean the barrel of the adapter. Using a new piece of cleaning paper, clean the face of the adapter. Repeat this operation, using a new piece of cleaning paper each time.
6. Use a blow brush or compressed air to remove any particles of cleaning paper which may be present.
7. Replace the adapters in the optical connector. Secure in place by clicking the retaining lever back into position.

Front Panel Soft Recovery (Cold Start)

An instrument "cold start" routine is provided to reset the instrument in the event of an unplanned hardware or firmware event. A cold start reboots the instrument and restarts the instrument from a default configuration file, erasing existing configuration information. Performing a cold start will therefore cause the current menu settings to be lost and will cause the instrument to power up in its default state.

Performing a Cold Start

1. Switch the instrument off and wait a few seconds.
2. Switch the instrument on and as the instrument boots up, look carefully at the display.
3. Wait for the "Starting instrument" text to be displayed. After a few seconds start to repeatedly press the **<Menu>** key until the Agilent splash screen appears with an options menu in the top left corner of the display.

   The following options are available:

   3 Cold start.

   5 Normal start.
4. Press 3 on the numeric keypad to select cold start.
5. The unit will then continue with the boot up process.
6. When the boot-up procedure is complete, the instrument displays a dialog box with the message

   "Instrument reset to default settings."

9 Hints and Tips

10
Quick Reference Tables

Only the main selections are listed here. It is assumed that the user understands that once a field is selected that the front panel **<Select>** button is then pressed to make the selection or to open the window.

Introduction

Use the front panel **<Smart Test>** and **<Print Control>** buttons for fast selection of SignalWizard, Measurements and Print Control functions. Use the **<Menu>** key to access all other functions.

Smart Test

You can use the front panel **<Smart Test>** button to quickly select one of the following:

Function – Using Smart Test	Path
SignalWizard	<Smart Test>, SignalWizard
Stored Settings, Optical Power, Frequency Measurement, Trouble Scan, Service Disruption, Round Trip Delay	<Smart Test>, Shortcuts > choose as required
Reset Instrument to default settings.	<Smart Test>, Reset Instrument

Print Control

Function – Print Control	Path
Copy a snapshot of the logging results to a Printer/File	<Menu>, System > Measurement Logging
Copy a screen dump of current window to a file or Printer	<Print Control>, Destination - Printer or File

Transmitter Functions

Function – Transmitter Interface	Path
Setting the Transmit Interface	<Menu>, Tx/Rx > Transmitter Settings
Setting Tx Signal Rate, Interface, Code, Operating Level	<Menu>, Tx/Rx > Transmitter Settings, Physical
Setting Tx OTN top level	<Menu>, Tx/Rx > Transmitter Settings, OTN
Setting Tx Mapping	<Menu>, Tx/Rx > Transmitter Settings, SDH/SONET
Setting Tx test pattern	<Menu>, Tx/Rx > Transmitter Settings, Pattern
Setting Tx PDH/DSn signal	<Menu>, Tx/Rx > Transmitter Settings, PDH/DSn
Setting TCM in the Transmitter (SDH only)	<Menu>, Tx/Rx > Transmitter Settings > SDH
Setting Thru Mode	<Menu>, Tx/Rx > Thru Mode
Coupling Transmit and Receive Settings	<Menu>, Tx/Rx > Coupling
Recall or Save instrument configuration	<Menu>, Tx/Rx > Stored Settings

Receiver Functions

Function – Receiver Interface	Path
Setting the Receiver Interface	<Menu>, Tx/Rx > Receiver Settings
Setting Rx Signal Rate, Interface, Code, Operating Level	<Menu>, Tx/Rx > Receiver Settings, Physical
Setting Rx OTN top level	<Menu>, Tx/Rx > Receiver Settings, OTN
Setting Rx Mapping	<Menu>, Tx/Rx > Receiver Settings, SDH/SONET
Setting Rx PDH/DSn signal	<Menu>, Tx/Rx > Receiver Settings, PDH/DSn
Setting Tandem Connection Monitoring (SDH)	<Menu>, Tx/Rx > Receiver Settings > SDH
Setting Rx test pattern	<Menu>, Tx/Rx > Receiver Settings > Pattern
Using Smart Test shortcuts	<Smart Test>, Shortcuts > select as required
Using SignalWizard	<Smart Test>, SignalWizard
Coupling Receive and Transmit Settings	<Menu>, Tx/Rx > Coupling

Test Functions

Function – Test Functions	Path
Adding Errors and Alarms to the transmit signal	<Menu>, Test Functions > Error and Alarm Generation
Adding Frequency Offset to the transmitted line signal	<Menu>, Test Functions > Frequency Offset
Adding Pointer Adjustments	<Menu>, Test Functions > Pointer Adjustments
Inserting Data Communications Channel	<Menu>, Test Functions > DCC/GCC Drop/Insert
Dropping Data Communications Channel	<Menu>, Test Functions > DCC/GCC Drop/Insert
Setting Up Triggers	<Menu>, Test Functions > Trigger Output
Switch off Test Functions	<Menu>, Test Functions > Switch Off

Overhead Setup

Function – Selecting Transmitter Overhead	Path
Setting Tx Overhead Trace Messages	<Menu>, Overhead Setup > Trace Messages
Setting Tx Overhead Labels (Signal Labels, Sync Status)	<Menu>, Overhead Setup > Labels
Setting Tx Overhead APS Messages	<Menu>, Overhead Setup > APS Messages
Setting Tx Overhead H4 Sequence	<Menu>, Overhead Setup > H4 Sequence
Setting Tx Overhead Bytes	<Menu>, Overhead Setup > Byte Setup
Setting Tx Overhead Sequences	<Menu>, Overhead Setup > Sequence Generation
Setting Tx DS3 Far End Alarm Channel	<Menu>, Overhead Setup > DS3 FEAC
Setting Tx DS1 Loop Codes	<Menu>, Overhead Setup > DS1 Loop Codes
Setting Tx Spare Bits	<Menu>, Overhead Setup > Spare Bits
Setting Tx Signalling Bits	<Menu>, Overhead Setup > Signalling Bits
Restore Byte Default values	<Menu>, Overhead Setup > Restore Defaults

Overhead Monitor

Function – Selecting Receiver Overhead Monitor	Path
Using Rx Overhead Monitor Trace Messages	<Menu>, Overhead Monitor > Trace Messages
Using Rx Overhead Labels (Signal Labels, Sync Status)	<Menu>, Overhead Monitor > Labels
Using Rx Overhead APS Messages	<Menu>, Overhead Monitor > APS Messages
Setting Rx Overhead H4 Sequence	<Menu>, Overhead Monitor > H4 Sequence
Using Rx Overhead Bytes	<Menu>, Overhead Monitor > Byte Monitor
Capturing an Overhead Sequence	<Menu>, Overhead Monitor > Sequence Capture
Capturing Data (OTN frames, SONET/SDH Overheads)	<Menu>, Overhead Monitor > Data Capture
Setting Rx DS3 Far End Alarm Channel	<Menu>, Overhead Monitor > DS3 FEAC
Setting Rx DS1 Loop Codes	<Menu>, Overhead Monitor > DS1 Loop Codes
Setting Rx Spare Bits	<Menu>, Overhead Monitor > Spare Bits

Function – Selecting Receiver Overhead Monitor	Path
Setting Rx Signalling Bits	<Menu>, Overhead Monitor >Signalling Bits
Setting Rx Sa Bits	<Menu>, Overhead Monitor > Sa Bits

Results

Function – Results and Measurement Timing	Path
View Trouble Scan Result	<Menu>, Results > Trouble Scan
Select Measurement Timing	<Menu>, Results > Measurement Timing
View Alarm Seconds Result	<Menu>, Results > Alarm Seconds
View Selected Measurement Error Summary Result	<Menu>, Results > Error Summary
View Measurement Errors Result	<Menu>, Results > Errors
Measure Performance Analysis	<Menu>, Results > Performance Analysis
Viewing Pointer Activity	<Menu>, Results > Network Measurement > Pointers
Measuring Service Disruption	<Menu>, Results > Network Measurement > Service Disruption
Measuring Round Trip Delay	<Menu>, Results > Network Measurement > Round Trip Delay

Function – Results and Measurement Timing	Path
Measure Frequency	<Menu>, Results > Signal Quality > Frequency
Measure Optical Power	<Menu>, Results > Signal Quality > Optical Power
View graph	<Menu>, Measurement Record > Graph Viewer

System Functions

Function – Remote Control, Date/Time, Preferences and Calibration	Path
View System Options and Software Revision	<Menu>, System > Options
MS-REI/REI-L result monitor selection	<Menu>, System > Preferences
MS-AIS/AIS-L alarm monitor selection	<Menu>, System > Preferences
G.826 collect ES, SES, BBE enable	<Menu>, System > Preferences
Enhanced RDI enable	<Menu>, System > Preferences
Select M0, M1 byte use	<Menu>, System > Preferences

Function – Remote Control, Date/Time, Preferences and Calibration	Path
STS-1 bulk filled stuff column overwrite	<Menu>, System > Preferences
Beep on Error audio control	<Menu>, System > Preferences
Save System Preferences settings as default	<Menu>, System > Preferences
Set up remote operation via RS 232, GPIB or Lan	<Menu>, System > Remote Control
Setting Time and Date	<Menu>, System > Time and Date
Calibrate instrument	<Menu>, System > Calibration

System Functions – Measurement Logging

Function – Measurement Logging	Path
Set up Logging conditions (when, and results selection)	<Menu>, System > Measurement Logging, Enable Logging
Log results to File or Printer	<Menu>, System > Measurement Logging, Destination
Print Logged Results	<Menu>, System > Measurement Logging, Destination (Printer)
Set up Logging Interval Report	<Menu>, System > Measurement Logging, Interval Report
Log Errored Seconds	<Menu>, System > Measurement Logging, Errored Seconds
Select Logged Reports	<Menu>, System > Measurement Logging, Logged Reports
Log Alarmed Seconds	<Menu>, System > Measurement Logging, Alarmed Seconds

System Functions – File Manager

Function – File Manager	Path
Copy logging files to floppy disk drive (A:), or delete	<Menu>, System > File Manager, Logging, Drive (Internal)
Copy to or get Screen Dumps from floppy disk drive (A:)	<Menu>, System > File Manager, Screen Dumps
Copy to or get Stored Settings from floppy disk drive (A:)	<Menu>, System > File Manager, Stored Settings
Copy to or get your own User Help files from floppy disk.	<Menu>, System > File Manager, User Help

10 Quick Reference Tables

Index

Numerics

A

B

C

D

E

F

G

T

U

V

W

In this book:
This book is a guide to the use of the OmniBER OTN.
It is aimed at the new and experienced user.

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